CLAIMS

What is claimed is:

1. A system for modulating cardiac blood flow of a patient by intermittently applying and releasing pressure on a limb of the patient, the device comprising:

at least one limb attachment, the limb attachment comprises an at least one generally encompassing member substantially surrounding the limb perimeter in at least one location, at least one actuator for pulling and releasing the flat member;

at least one processing unit for issuing commands to the at least one actuator.

2. The system of claim 1 wherein the commands are determined based on an at least one physiological parameter of the patient.
3. The system of claim 1 further comprising an at least one connection to an external sensor measuring the at least one physiological parameter of the patient.
4. The system of claim 1 further comprising an at least one sensor for measuring at least one physiological parameter of the patient.
5. The system of claim 1 where the actuator is a mechanical actuator.
6. The system of claim 1 wherein the limb attachments are attached to any pf the following: a foot, a calf, a shin, a hip, an upper arm, a forearm.
7. The system of claim 1 wherein the system comprises at least one pair of limb attachments.
8. The system of claim 7 where each pair of limb attachments is symmetrically attached to the body of the patient.
9. The system of claim 1 wherein the actuators are attached to the patient.
10. The system of claim 1 where the at least one encircling member is a strap, a flap, a closure, or a sleeve.
11. The system of claim 2 wherein the physiological parameter is sensed by an electrocardiograph or photoplathismography device.

12. The system of claim 2 wherein the physiological parameter is at least one of the following: heart rate; blood pressure; blood vessels; movement; temperature; sweat amount; sweat composition.

13. The system of claim 1 wherein the device applies pressure such as to modulate cardiac blood flow by increasing the arterial and coronary pressure during the diastole.

14. The system of claim 1 wherein the device applies pressure such as to modulate cardiac blood flow by increasing the aorta and peripheral arteries pressure during the systole.

15. The system of claim 1 whereby the device improves peripheral circulation such as to reduce peripheral resistance.

16. The system of claim 1 wherein pressure is applied to improve venous return.

17. The system of claim 1 wherein the device applies pressure gradients such as to promote vasodilatation.

18. The system of claim 1 wherein the device applies falling pressure gradient such as to produce venous suction effect.

19. The system of claim 1 wherein the system applies pressure with high gradients such as to create sheer forces along the arteries, promoting coronary dilatation.

20. The system of claim 1 wherein the system applies pressure in several locations along the limbs wherein the pressure is applied substantially in a synchronized fashion.

21. The system of claim 1 wherein the intermittent pressure applications are synchronized.

22. The system of claim 1 wherein the intermittent pressure releases are synchronized.

23. The system of claim 1 wherein the delay between intermittent pressure applications is less than 500 milliseconds.

24. The system of claim 1 wherein the delay between intermittent pressure applications is less than 100 milliseconds.

25. The system of claim 1 wherein the intermittent pressure is applied sequentially.

26. The system of claim 25 wherein the pressure application starts from distal regions.

27. The system of claim 2 wherein the system is responsive to an at least one physiological event.

28. The system of claim 27 wherein the at least one physiological event is used as a trigger for applying and releasing intermittent pressure on the limb of the patient

29. The system of claim 27 wherein the processing unit analyzes the at least one physiological parameter and controls the system activity accordingly.

30. The system of claim 1 wherein the commands issued by the processing unit relate to any of the group made of: pressure levels, pressure durations, no-pressure duration, pressure rise time, pressure fall time, pressure delays among locations, rest periods, sequence of pressure levels.

31. The system of claim 2 wherein the commands issued by the processing unit relate to a pressure delay from physiological event.

32. The system of claim 1 wherein the at least one limb attachment further comprises a sensor.

33. The system of claim 32 wherein the sensor is an external sensor.

34. The system of claim 32 where the sensor senses pressure or force or temperature or impedance or plethysmography.

35. The system of claim 34 wherein the pressure or the force or the temperature are used in determining the commands issued by the processing unit.

36. The system of claim 1 wherein the commands are issued according to a timing mechanism.

37. The system of claim 2 wherein the pressure is applied according to the heart beat of the patient.

38. The system of claim 2 wherein the pressure is applied every predetermined number of heart beat cycles.

39. The system of claim 1 wherein the system is used for treating heart failure.

40. The system of claim 1 wherein the system is used for treating coronary disease.

41. The system of claim 1 wherein the system is used for treating angina pectoris.

42. The system of claim 1 wherein the system applies pressure on the limb by applying a pre-determined force.

43. The system of claim 1 wherein the system applies pressure on the limb by applying a pre-determined pressure.

44. The system of claim 1 wherein the volume required for the actuator used to produce the pressure at each of the at least one limb attachments is less than 2000 cc.

45. The system of claim 1 wherein the volume required for the actuator used to produce the pressure at each of the at least one limb attachments is less than 1000 cc.

46. The system of claim 1 wherein the weight required for the actuator used to produce the pressure at each of the at least one limb attachments is less than 3Kg.

47. The system of claim 1 wherein the weight required for the actuator used to produce the pressure at each of the at least one limb attachments is less than 1.5Kg.

48. The system of claim 1 wherein the weight required for the actuator used to produce the pressure at each of the at least one limb attachments is less than 1Kg.

49. The system of claim 1 wherein the pressure rise time is less than 1 second.

50. The system of claim 1 wherein the pressure rise time is less than 300 milliseconds.

51. The system of claim 1 wherein the pressure rise time is less than 100 milliseconds.

52. The system of claim 1 wherein the pressure rise time is less than 50 milliseconds.

53. The system of claim 1 wherein the pressure fall time is less than 1 second.

54. The system of claim 1 wherein the pressure fall time is less than 300 milliseconds.

55. The system of claim 1 wherein the pressure fall time is less than 100 milliseconds.

56. The system of claim 1 wherein the pressure fall time is less than 50 milliseconds.

57. The system of claim 1 wherein the pressure is within the range of 15-400 mmHg.

58. The system of claim 1 wherein the pressure is within the range of 25-150 mmHg.

59. The system of claim 1 wherein the pressure is within the range of 40-100 mmHg.

60. The system of claim 1 wherein the pressure application duration is less than 3 seconds.

61. The system of claim 1 wherein the pressure application duration is less than 1 second.

62. The system of claim 1 wherein the pressure application duration is less than 300 milliseconds.

63. The system of claim 1 wherein the pressure application duration is less than 100 milliseconds.

64. The system of claim 1 wherein the actuator comprises at least one motor.

65. The system of claim 1 wherein the actuator comprises an at least one mechanical element.

66. The system of claim 65 where the at least one mechanical element is any of the following group: a rod; a tooth wheel; an eccentric wheel.

67. The system of claim 1 wherein the actuator comprises at least one eccentric wheel.

68. The system of claim 1 wherein the system includes at least one data logging unit.

69. The system of claim 68 wherein the data logging unit stores activity information of the system comprising time, pressure, usage information.

70. The system of claim 2 wherein the system includes at least one data logging unit.

71. The system of claim 70 wherein the data logging unit stores the at least one physiological parameter.

72. The system of claim 1 further comprising an analysis unit for data reviewing and analysis.

73. The system of claim 3 further comprising an analysis unit for data reviewing and analysis.

74. The system of claim 4 further comprising an analysis unit for data reviewing and analysis.

75. The system of claim 4 further comprising an unit for data telemetry.

76. The system of claim 4 further comprising an unit for on and off command of the system.

77. A method for modulating cardiac blood flow of a patient by applying intermittent pressure on a limb of the patient, the method comprising the steps of:

issuing an at least one command to an at least one actuator associated with an at least one limb attachment; said at least one actuator causing the beginning or end of application of pressure by the at least one limb attachment on the limb, thereby changing the circumference of the limb of the patient thus modulating the cardiac blood flow of the patient;

executing said command by the at least one actuator.

78. The method of claim 77 wherein the method further comprises the following steps:

receiving an at least one physiological parameter from an at least one sensor associated with the patient;

determining the beginning of diastole based on the at least one physiological parameter received from the at least one sensor associated with the patient

79. The method of claim 77 wherein the pressure is applied only during systole.

80. The method of claim 77 wherein the pressure is applied symmetrically to the body of the patient.

81. The method of claim 77 wherein the pressure is applied to the body of the patient starting at distal limb attachments.

82. The method of claim 77 wherein the pressure is applied by shortening of one or more straps circulating the limb.

83. The method of claim 77 wherein the pressure is applied by pressing with one or more movable plates.

84. The method of claim 77 wherein the pressure is applied by pressing with one or more flap moving in and out of a housing.

85. The method of claim 77 further comprising a step of storing data.

86. The method of claim 85 where the data includes activity information comprising time, pressure and usage information.

87. The method of claim 85 wherein the data includes physiological data.

88. The method of claim 77 further comprising the step of measuring the at least one physiological parameter.

89. The method of claim 77 wherein the application of pressure by the at least one limb attachment on the limb is performed intermittently.

90. The method of claim 77 further comprising a step of evaluating the physical condition of the patient prior to issuing the at least one command.

91. The method of claim 77 wherein the method improves the blood flow of the coronary artery.